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10/046,607	01/16/2002	Barry Lee-Mean Yang	RD-25,993-7	2869

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GLOBAL RESEARCH CENTER
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NISKAYUNA, NY 12309

EXAMINER

PADGETT, MARIANNE L

ART UNIT	PAPER NUMBER
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1762

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DATE MAILED: 07/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/046,607

Applicant(s)

Yang et al

Examiner

M.L. Padgett

Group Art Unit

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— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- ☒ Responsive to communication(s) filed on 4/17/03
- ☐ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 4-8, 12, 17-19, 52-58 + 62-73 is/are pending in the application.
- Of the above claim(s) 62-73 is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 4-8, 12, 17-19, 52-58 + 62-73 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).
- ☐ All ☐ Some* ☐ None of the:
 - ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____
 - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

6 sheets from parent 07/27/654

- ☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- ☒ Notice of Reference(s) Cited, PTO-892 1 from parent
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Interview Summary, PTO-413
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Other _____

Office Action Summary

1. Applicant's election with traverse of Group I, method claims 4-8, 12, 17-19 and 52-58 in Paper No. 4 is acknowledged. The traversal is on the ground(s) that the search and examination of a method of plasma arc deposition of multiple layers from organosilicon and oxidant precursors, and also of that of the product formed by the same method, does not impose a serious burden on the examiner. This is not found persuasive, because the method limitations for forming the product do not determine the search for the product, and are not the only way of forming like structures, hence the searches are NOT the same. As other deposition techniques, via different plasmas (microwave, parallel plate, etc.) or photo deposition, or solution depositions, may be used to achieve like structures as claimed products, the examination and searches differ considerably with significant burdens. Furthermore, for the inorganic UV absorbing layers, none of the article claims have any Si or result from any organic Si precursors, hence are not of like structure to the method claims as presently written.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 4-8, 12, 17-19 and 52-58 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 4, "an article" is introduced in the preamble (line 1) and deposited in the deposition chamber (line 5), then the first material forms "an interlayer on the article" in lines 8-10, however in the last line of claim 4, "the substrate" is referred to, which has absolutely no antecedent basis, nor have any of the layers been deposited thereon. For examination purposes over the art, it will be assumed that substrate equals article. Applicant is also directed to claim 57, which refers to "substrate".

In claim 5, "the first material or the second material comprises an evaporated elemental metal", however in claim 4, the first material is already required to comprise "an organosilicon material and a first oxidant" (lines 8-10), and the second material is required to comprise similar Si and oxidant materials in lines 11-12. Is the inclusion of the first material in claim 5 an oversight, or is the elemental metal in addition to the previously required reagents, which are required to form a polymerized organosilicon material? Similarly, what is the intent for the second material, and the inorganic UV absorbing materials layer? Also see claims 7, 17-19 for like unclear intent. Review of the specification did not clarify the issue, as no interlayers were disclosed as employing any metal, let alone evaporated metal. The closest disclosure is found on page 14 (top) of the specification, where a graded transition may be accomplished between the interlayer deposit and the UV absorbing layer, but no disclosures for the interlayer as a whole containing metal, or mixed organosilicon-evaporated metal deposits for all of any layer, interlayer, UV absorbing or abrasion resistant layers. Page 22, lines 16-23, provides for transition graded composition between UV absorbing and abrasion layers, but again, not for mixtures in the layers themselves. Furthermore, taught examples of the UV absorbing layer (page 14, line 8-page 15, line 7) all have organometallic or metal (i.e. evaporated or elemental) sources, not the mixture or the organosilicon as claimed here.

Similar problems may be noted with respect to claim 12, where the first material is said to comprise hydrocarbon, unless one is considering organosilicons to be inclusive thereof, but then one has broadened the previously required limitation, or ambiguously added to it.

3. Claims 4-8, 12, 17-19 and 52-58 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed,

had possession of the claimed invention.

As discussed above, no disclosure for combining organosilicon and evaporated metal for depositing either the first layer called the "interlayer", nor the second layer called the UV absorbing layer, was found in the original specification, hence these claims appear to contain New Matter as delineated in the second paragraph of section 2. As a further example, claim 19's reagent combination of a organosilicon, evaporated elemental Zn, sulfur and possibility another oxidant besides S, was not found in the original disclosure, and what deposit it is suppose to produce is therefore not defined.

4. While the examiners have been directed to no longer reject incorrect article use as related to antecedent basis, unless it makes the claimed meaning incomprehensible or ambiguous, applicants might consider changing "an" to --the-- in claims 53-56 before "ultraviolet absorbing material" (introduced in claim 4, line 13) and "abrasion resistant material" (introduced in claim 6, line 3) to improve the clarity.

5. The disclosure is objected to because of the following informalities: the specification needs proof reading, particularly to fill in the blanks for serial numbers or updated those for patent numbers.

Appropriate correction is required.

6. Prior art from the parent case is made of record and copies of the PTO-892 and PTO-1449 forms therefrom are enclosed.

It is noted that Zagdoun, applied in the parent, remains relevant in that it teaches coating a glass substrate with layers inclusive of a first layer (intermediate) that may be silicon dioxide based, deposited from organosilicon compounds by plasma CVD, but not requiring the deposit to be "polymerized organosilicon material" which will include organic aspects; the second layer being an inorganic metal oxide from organometallic precursors or from vacuum deposition, such

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as cathodic sputtering in presence of oxygen from metal targets or ceramics, where Zn oxide, or In oxide, or ZnO:In are possible compositions; and an optional third coating of the composition and deposition techniques as the intermediate coat. Differing from applicants' claims, but like applicants' specification, Zagdoun does not suggest that the second UV absorbing layer be made from organosilicon, nor that it be mixed with evaporated metal to form the second deposit.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 4, 6 and 53-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu et al (5,718,967), in view of Schram et al.

Hu et al (967) teach a multi-layer deposit on polycarbonate substrates, which are an improvement over us of breakable glass substrates that were previously used. Hu et al first deposit an adhesion promoter layer, equivalent to applicant's interlayer, in that it is a plasma polymerized deposit from an organosilicon, such as tetramethyldisiloxane (TMDS) or hexamethyldisiloxane (HMDS), in the substantial absence of oxygen, define to mean "that the amount of oxygen present in the plasma polymerization process is insufficient to oxidize all the silicon and carbon in the organosilicon compound" (col. 2, lines 53-57). Thereafter, a plasma polymerized organosilicon ("protective layer", also equivalent to the interlayer) is deposited on the adhesion layer, in the presence of a sufficient stoichiometric excess of oxygen to form $\text{SiO}_{1.8-2.4} \text{C}_{0.3-1.0} \text{H}_{0.7-4.0}$ where functional groups including -Si-O-Si-, -Si-CH₂-, Si-H or Si-OH remain. An optional third layer of SiO_x may be applied, also via plasma polymerization, where there is used a stoichiometric excess of oxygen, plus a higher power density than used for the

"protective layer". Either of these last two layers may be considered abrasion resistant, and the protective layer and SiO_x layer may be alternately repeated, as in Ex. 2 in col. 6, so plasma polymerized then inorganic layers of materials as presently claimed by applicant are produced by the Hu et al (967)'s process. Hu et al is silent as to the UV absorbent qualities of their inorganic layer, but so is applicants' specification about any plasma deposited organosilicon inorganic layer, so no characteristic providing the claimed UV absorbing properties may be determined, however as the material compositional affects are taught, like properties therefore would have been expected to be inherent in the deposit. In Hu et al (967), see the abstract; background; summary; col. 2, lines 28-37, 44-60; col. 3, lines 1-8, 18-34, 43-57; col. 4, lines 14-25+ and col. 5, line 54- col. 6, line 45.

A difference between Hu et al and applicants' claims, is that independent claim 4 requires remote plasma generation using an arc plasma, while Hu et al generally teaches PECVD, or exemplifies a plasma magnetron cathode plasma apparatus. Schram et al teaches a plasma treatment technique effective for etching, deposition, etc., generically, where plasma is formed in a generating chamber or generator (13), that has gaseous or liquid precursors injected in it, then the plasma produced is directed into plasma treatment chambers and towards the substrate. Schram et al's plasma generator uses a cascade-arc configuration with a pressure maintained above 0.1 bar to preferably 3.5 bar. The plasma treatment chamber is further pumped out to pressures below 0.05 bar. See the abstract; Figures 1-2; column 4, line 49 to column 6, line 15+. Schram et al do not limit their reactors use to any specific precursors, but do indicate that hydrocarbon containing compounds are desirable (col. 5, lines 9-12).

It would have been obvious to one of ordinary skill in the art to use a plasma process, such as taught by Schram et al for the deposition desired in Hu et al (967), because the primary reference generically suggests plasma depositions, but no specific type of plasma apparatus is

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necessary or required, providing teaching of the types of gases and plasma conditions necessary to produce different effects from the precursors. Thus, one would expect any prior art plasma apparatus to be useful, if capable of so processing such precursors. Schram et al's technique would have been expected to be effective for gaseous or liquid precursors, such as those suggested by Hu et al in col. 3, line 43-61, as they are in the correct state and contain Schram et al's hydrocarbon moieties. Since Schram et al's process allows for effectively equivalent treatment of liquids or gaseous reactants, etc., with ability to flush out the system with a flushing gas (column 3, lines 5-60+), one of ordinary skill in the art would have found it obvious to use in Hu et al's process as one would have expected the apparatus and process to be useful for multiple layer deposition processes, such as described in Hu et al, where not having to change chambers is consistent with the primary reference and provides efficiency and decreases possible sources of contamination, thus motivating use of Schram et al's particular configuration. It also enables the ability to produce graded interfaces (which Hu et al's second plasma polymerized layer can be considered to be with respect to the adhesion and the SiO_x layer).

While Hu et al does not discuss the coefficient of thermal expansion, the various layers and the substrate, their adhesion discussion and effects are consistent with the claimed coefficient relationship, because of the graded change and because the claimed relationship would be expected for the gradual change in composition effected by Hu et al.

9. Claims 4, 6 and 53-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al (EPO 887,437 A2), in view of Hu et al ('967) and optionally in view of Schram et al.

Hu et al and Schram et al are discussed above. Yang et al is similar to Hu et al, but uses a remote arc plasma for the PECVD instead of generic disclosure or Hu et al's examples

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with an *in situ* plasma, so Hu et al is cumulative in showing types of results for the depositions of Yang et al.

In Yang et al, it is taught to deposit protective (abrasion resistant) coatings on glass or plastic (polycarbonate) substrates, via a current arc plasma generator, where the reactant gases are injected into the plasma outside the generating area and a diverging nozzle injector is used to deliver plasma and reactants to the substrate in a vacuum chamber at reduced pressures, exemplified by values a little under 1 torr (tables). Yang et al teach silicon oxide based deposits from precursors, such as TMSO or TMSO or octamethylcyclotetrasiloxane, etc., and that deposits can be continuously or discretely graded, by for example varying the feed rate of oxygen. Stoichiometric SiO_2 or Si oxide based deposits with small amounts of C and H (page 2, lines 34-45) with plasma polymerization are discussed on page 7, line 49-52, so multiple discrete gradations are considered to be suggestive of the claimed first and second layers, with the continuous reading on grading thereof. See the abstract, page 2, lines 3-7 and 30-58; examples on pages 3-4, esp. table 1 and page 4, lines 11-53; and page 5, lines 8-52. While Yang et al does not explicitly teach plasma polymerized organosilicon followed by an inorganic layer from the same reactants, as noted their teaching are suggestive thereof, and Hu et al provides explicit motivation for producing such with Yang et al's means, as well as motivation for the third layer to give the benefits thereof taught by Hu et al.

Yang et al does not discuss the pressure of the plasma generating chamber or its relationship to the deposition chamber pressure, however as the deposition chamber is specifically said to be at reduced pressure and to be a vacuum chamber, it would have been obvious to one of ordinary skill in the art to expect it to be at a lower pressure than the plasma generating chamber. Alternately, Schram et al discussed above uses an analogous apparatus

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to that of Yang et al, with the claimed pressure relationship and expected to be useful for Yang et al's taught reagents, hence providing further motivation for the claimed pressure.

Note above arguments for UV absorbing again apply. Also, Yang et al teach protection against UV degradation (page 2, line 6-7) and improved UV stability from OMCTS plasma deposits, where absorbance (low but explicit) of UV wavelength (page 7, lines 12-38) are discussed, so UV absorbance can be considered substantiated. ZnO coatings via reactive sputtering or PECVD (arc included) are discussed as UV filters (page 6, lines 14-15), but no discussion of the use with the above deposits, or combined with organo Si deposits as applicant's further claims (not included here), appear to be unsupported by claiming.

Note that while Yang et al has overlapping inventors, it is a different inventive entity and was published about 3 months before the effective filing date of the present application.

10. Claims 5, 7-8, 12, 17-18 (19?) and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al (EPO), in view of Hu et al, and optionally Schram et al as applied to claims 4, 6, 53-57 above, and further in view of Tomonaga et al or Reed et al (4,927,704), optionally considering Schiller et al (087) or Thurm et al.

While the above discussed combination does not discuss mixing organosilicons and evaporated elemental metals, such as Zn, when depositing the second or the inorganic UV absorptive layer, the patents to Tomonaga et al or Reed et al (704), both provide for deposition of mixtures of metal oxide and Si oxide. In Tomonaga et al, see the abstract; col. 3, line 52- col. 4, lines 2 and 11-19, and claim 9, for teachings of ultraviolet absorbent glass with coatings of SiO₂ followed by mixtures such as ZnO-SiO₂, where alternative coating techniques include vacuum deposition, sputtering, CVD and wet coating processes, where the SiO₂ supplies intermediate characteristics, and the oxides like ZnO provide UV absorption, hence it would have been obvious to one of ordinary skill in the art that given the advantages of coating

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combinations taught by Tomonaga et al, and given the above combination with Yang et al (EPO) and Hu et al (967), where multi-layers deposits using organosilicons, as well as discussion of the desirability of UV absorptive films are taught, that the inclusion of ZnO as taught by Tomonaga et al, would have been desirable and effectively employed via the arc plasma deposition techniques as discussed above in Yang et al plus Hu et al, optionally in view of Schram et al, because similar layer compositions, purposes, and overlapping types of coating techniques are contemplated by Tomonaga et al.

Alternately, Reed et al (704) teaches abrasion resistant coatings that are gradational and applied by Plasma enhanced CVD where organosilicon or organometallics may be used to apply metal oxides or silicon oxides or mixtures of these materials, hence providing reasons for obviousness analogous to those discussed for Tomonaga et al. In Reed et al (704), see the abstract; col. 1, lines 5-22 (note susceptibility to UV degradation is a problem being solved therefore, also relates to UV absorption); summary; col. 2, lines 59-68; col. 3, lines 62- col. 4, lines 30 and 62-68 and col. 5, lines 33-64.

Optionally, considering Thurm et al (abstract; col. 1, lines 5-12; col. 2, lines 38-66; and col. 3, lines 1-8 and 21-42), who teach metal oxides, such as ZnO, vacuum deposit by vaporizing either the metal oxide or the metal, with use of oxygen atmosphere to control the stoichiometry of the deposit, with equivalently taught techniques including PECVD using organometallic compounds; or Schiller et al (087) (abstract; figures; col. 3, lines 10-25+; col. 4 lines 8-50+, etc.), who teach plasma vacuum depositions using hollow cathode arc plasma sources where metal or metal oxide may be vaporized and reactive gas atmospheres employed, such as O₂. Thus, with the evidence of either Thurm et al or Schiller et al for the effectiveness of metal oxide deposits from vaporized metal sources, including use of arc plasmas remote from substrate/deposition sites, it would have been further obvious to employ such techniques in the

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Yang et al in view of Hu et al combination, that optionally considers Schram et al. Also, it is noted that Thurm et al shows the equivalence of metal vaporization and use of organometallic as sources for metal oxides, thus showing overlapping precursors with teachings of Yang et al, thus equivalence; while Schiller et al demonstrates the explicit use of the arc plasma techniques with vaporized metal plus oxidant, that is analogous to the arc plasma of Yang et al.

11. The literature article to Minami et al is noted to have teachings analogous to those of Reed et al or Tomonaga et al, for depositing Zn oxide mixed with Si oxides.

Also of interest to arc plasma metal oxide depositions are Schiller et al (248); MacGill et al ("Cathode Arc Deposition of..."); Anders et al ("Formation of metal oxides by..."; Halpern (US 5,571, 332) and Gordon et al (Arc Plasma Technology...).

12. Any inquiry concerning this communication from the examiner should be directed to M. L. Padgett whose telephone number is (703) 308-2336. The examiner can generally be reached on Monday-Friday from about 8:30 a.m. to 4:30 p.m.; and fax phone numbers are (703) 872-9310 (regular); (703) 872-9311 (after final); and (703) 305-6078 (unofficial).

M.L. Padgett/dh 6/13/03
July 1, 2003



MARIANNE PADGETT
PRIMARY EXAMINER